



O'BELLX UNIT ON SLOPE NEAR RESORT
IN EUROPE// JOËLLE BOZON

Remote Avalanche Control Systems: High Tech on the Mountain

Brian Gould

ANY AVALANCHE PROFESSIONAL tasked with actively controlling avalanches is well aware of the concept of timing. Too early or too late may mean another sleepless night versus a healthy pile of debris on the road or worksite from a full path cleanout. Although bad timing can be the result of inaccurate forecasting, more often than not it is a result of the inability to initiate a trigger (explosion) in the start zone at the right time, either due to poor visibility, dangerous flying weather, or unsuitable conditions for avalanche technicians to access by ground.

Enter Remote Avalanche Control Systems (RACS). Although not a new technology in our industry, Canada has had relatively limited experience with RACS other than along a few highway corridors in BC and one in Alberta. Not surprisingly, RACS dot the landscape in much of the European Alps. In addition, several mining operations in South America and a few highway departments in the United States have embraced the technology.

Globally, there appears to be increasing interest in RACS every year. This may be partly due to reduced tolerance to lengthy closures at alpine ski areas, and along increasingly congested travel corridors, but also due to numerous anecdotal reports and research indicating that RACS provide good value in the right situation. Even in Europe where permanent engineered solutions to avalanche problems are the norm, avalanche mitigation incorporating RACS is becoming a popular alternative, and a way to avoid the high capital costs of avalanche sheds or structural protection. This article presents a brief overview of RACS types currently available in Canada, and describes some of the advantages of each. Brief summaries of some of the RACS public relations events that occurred in association ISSW 2013 in France are also included.

➔ What are RACS?

For the purposes of this article, RACS refers to any avalanche explosive control system that is installed in and around starting zones, and uses telemetry and electronics to relay and transmit a coded triggering sequence from a computer (office or laptop-based) to a fixed installation on the mountain. Bomb-tram systems and systems that are suspended beneath a helicopter are not included.

Although several types of RACS have entered the marketplace over the years, a handful of types have stood the test of time. Currently, there are three main companies offering RACS systems to the Canadian marketplace: T.A.S. gas-based products from France (distributed in Canada by AvaTek Mountain Systems Inc.); Wyssen Avalanche Control AG avalanche control towers from Switzerland (represented in Canada by Hans-Juerg Etter); and Inauen-Schatti AG's Avalanche Guard® and Avalanche Master® from Austria (distributed in Canada by C-I-L Explosives in partnership with Maple Leaf Powder Ltd.).

GAS-BASED RACS

You can't get too far down the road in our business without hearing about the immensely successful Gazex installations protecting some BC and Alberta highways. After an initial trial starting in 1992 of two fixed cannons on the top of a rather finicky path on the Duffey Lake highway, the BC Ministry of Transportation and Infrastructure's Avalanche Program embraced the technology and installed 19 more over a period of seven years from 1993-2000 along Kootenay Pass, one of their highest risk avalanche areas in the province. Including the two cannons on the Sunshine Village road, there are now 28 installed cannons in Canada, and over 2,300 in the world dotting the landscape above transportation corridors, ski areas, mines, and now Olympic ski runs with 107 at Rosa Khutor Alpine Resort in Sochi, Russia.

For over 20 years, France's T.A.S. (Technologie Alpine de Securite) has been the sole provider of gas-based systems—the three main types in the T.A.S. fleet being Gazex, Gazflex, and a newer portable, less invasive system called O'Bellx. Only Gazex has been installed in Canada so far.

The basic concept of gas-based RACS involves mixing two individually harmless gases inside a downward-oriented explosion chamber for approximately seven seconds, followed by ignition via a timed electronic spark. With Gazex and Gazflex systems, gas is normally supplied by piping from a nearby gas "farm" (a small shelter housing telemetry, electronics, and gas bottles) to up to a maximum of ten fixed cannon locations in start zones (an all-in-one autonomous system is also available for individual cannon placements). O'Bellx is a fully self-contained telemetry/electronics/exploder unit similar to the Daisybell system (another T.A.S. product), positioned on a permanently installed pedestal (mast) by way of helicopter long-line transport system. With a specialized hook system, a reverse of the docking procedure allows for removal and transport to the valley shop at the end of the season, or when bottle replacement or maintenance is required. As a result, once the unit is installed there is no need for a worker to access the target site again, other than to inspect the foundation of the installation on occasion.

Some of the key advantages to gas include: inexpensive cost per blast (after initial capital cost); a large number of shots with standard size gas bottles; uses commonly available gas; no duds, and no regulatory issues with the transport or storage of conventional explosives; and some limited ground vibration to add to the air blast effect (with Gazex/Gazflex).



AVALANCHE GUARD INSTALLED AT LAURIE
PATH EAST OF REVELSTOKE // MOTI

EXPLOSIVES-BASED RACS

Explosives-based systems incorporate devices that deploy cast explosives in either a tethered or untethered configuration. A tethered configuration allows for the charge to be suspended on a rope. Charges are either projected with a mortar system from a fixed tower/box combo, or lowered from a specialized deployment box. The main types on the market in Canada include Avalanche Guard/Avalanche Master, and the Wyssen Tower.

AVALANCHE GUARD AND AVALANCHE MASTER

Although a smaller player than Gazex in the Canadian marketplace (installed in only one path in Canada so far), Inauen-Schatti AG's mortar type RAC system is an engineering marvel. Licensed as a remote magazine, the mast-mounted boxes house ten pre-loaded four-kilogram TNT charges (in cylindrical firing tubes), with associated mortar propellant. Each box is equipped with a servo-operated door that can be opened to the elements to fire primed charges out the door in pretty much any weather conditions. The telemetry and electronics are housed in the same box as the explosives.

The Avalanche Guard is an untethered system that projects a charge in an arc trajectory to a pre-registered target, while the Avalanche Master is a tethered (up to 40m rope) version with the mast usually inclined out over the slope to allow for



WYSSSEN TOWER INSTALLED NEAR
DAVOS // BRIAN GOULD

effective air blast. Due to the ability to vary the amount of mortar propellant, as well as adjust the azimuth of the box on the mast, the target location can be tweaked substantially after the hardware is installed on the mountain.

Advantages of the Avalanche Guard include the ability to locate all infrastructure in a safe area (e.g., at ridge top, away from steep slopes). In addition, the target location may be readjusted without having to re-install infrastructure. Advantages of the Avalanche Master include the ability to tether a charge to limit charge sliding, and create a solid four-kilogram TNT air blast.

WYSSSEN TOWER

A newcomer on the Canadian market, the Wyssen Tower LS12-5 is a market-leading RAC system in Switzerland and Austria, and shows great promise as a RAC system in Canada now that it has been approved by regulatory agencies (Hans-Juerg Etter, personal communication, April 26, 2013). The system is a self-contained unit (similar concept to O'Bellx) consisting of a portable explosives magazine deployment box that is seasonally installed on top of a remotely installed inclined mast. Inside the portable deployment box are 12 pre-loaded tethered charges loaded into a mechanically rotating tray (dispenser). The initiation sequence involves a release of a suspended charge on a tether up to 14m in length above the start zone.

Similar to the O'Bellx, the operational unit is removed and replaced remotely by helicopter long-line transport system, which allows for maintenance and reloading of explosives in a comfortable location in the valley. The magazine has a capacity of 12 charges, and although the charge size has not yet been confirmed in Canada, a robust five-kilogram charge is commonly used in European installations.

The main advantages of the Wyssen Tower include the portability of the deployment box (for worker safety, ease of reloading and maintenance, and summer storage), and the significant effective range of the air blast from the five-kilogram charge—up to a 130m fracture radius, according to Wyssen, which has been tested and verified by the WSL Institute for Snow and Avalanche Research SLF.

THE BOTTOM LINE

As with any large capital purchase, complete careful research before jumping into one particular type or brand. Everything from the site conditions and blast suitability, to availability of local installation expertise, to parts supply, to history of the RACS in the marketplace should be considered. Specific expertise may be required for detailed planning, business case analysis, and optimizing placement. A foundation engineer should be consulted for final positioning and anchoring of critically loaded components.

Although each of these products can appear costly on first glance, some installations may be more reasonable than one would think depending on foundation conditions, and proximity of the site to a shipping base. If multiple units are installed, volume discounts and shipping efficiencies can be capitalized on. Also, it appears competition in the marketplace has certainly been a good thing for the consumers of these products, with prices remaining pretty much the same since the first installs back in the 1990s. Cost per shot must still be factored in, but when one considers the enormous benefit to good timing when it comes to avalanche control, the payoff of installing RACS may be shorter than one would think.

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ISSW 2013 T.A.S. Night

During ISSW 2013 in Grenoble, approximately three busloads of international delegates were treated to a fine evening of wine and cheese, music, and art demonstrations at the T.A.S. factory just outside of Grenoble. Company directors and engineers gave an informative and impressive factory.

DAISYBELLS AND O'BELLX SHELLS LINED UP ROW BY ROW // BRIAN GOULD



Post-ISSW 2013 Wyssen Zermatt Avalanche Control Systems Tour

BASED ON THE 2013 APPROVAL by Canadian explosive regulators of their system in Canada, Wyssen Avalanche Control AG invited a few key Canadian organizations and companies to Zermatt after ISSW 2013 to view several Wyssen Tower systems installed in avalanche paths above roads, railways, and ski runs in the area. Representatives from the CAA, Parks Canada, and Alpine Solutions Avalanche Services attended. Highlights of the tour included a “show and tell” session in one of the main valley-based explosive loading bunkers as well as a spectacular helicopter tour of numerous fixed Wyssen Tower installations in and around Zermatt.

Company head Sam Wyssen and Canadian representative Hans-Juerg Etter were on hand to describe details of their system ranging from priming methods, foundation requirements for towers, and specific issues they have worked through during the approximately 13 years the system has been in production. A late afternoon presentation in Zermatt by local rescue veteran and Chief of Zermatt avalanche control, Bruno Jelk, IFMGA, provided good context as to how Wyssen systems are used to control many of the problematic avalanche paths in Zermatt.

SAM WYSSEN EXPLAINING THE DOCKING MECHANISM // JOE OBAD

